BIODEGRADATION OF PENTACHLOROPHENOL

MARTHA FLYNN
1999

A. ADDITIONAL EXPLANATORY NOTES

PAGE	NOTES
9 para 3	Pentachlorophenol is a persistent chemical in the environment because of the absence of microorganisms in the natural environment able to degrade PCP at the concentrations at which it is present.
57 Fig 2.13	Compounds XII – XVIII should not to be listed in the legend because they are not presented in the diagram.
76 last para	The negative results of the BBL Oxiferm® tube for ET01 were inconclusive and therefore the identification of ET01 by Yu (Pers. Comm., 1997) as *Bradyrhizobium* sp. was adopted.
96 first para	The increase in lag period does not accurately reflect the proportional reduction of PCP-degrading ET01 cell numbers for all combinations tested. For example at 150mg/l initial PCP concentration for the three combinations should theoretically produce a lag period three times that of ET01 in pure culture. The lag period was closer to twice that for ET01 in pure culture. This is one example of the three cultures in combination achieving a better result than was expected or seen with ET01 with only one of the other isolates (lag period would have had to be well below twice that for ET01 in pure culture). For initial PCP concentration of 50mg/l for the three isolates, the lag period was almost four times that of ET01 in pure culture at the same initial PCP concentration. The full inoculation of ET01 cells was not tested in combination with ET02 and ET03.
97 Fig 4.13	The following legend applies. PCP concentration mg/l (o); Ln Cell numbers (•).
101	Viable counts were repeatedly attempted and were initially the main aim of the project however due to technical difficulties were never deemed scientifically acceptable. Because ET02 and ET03 contributed minimally to the biomass (as measured by OD) only ET01 was considered for Ki calculations.
111 line 3	This statement reconfirms that ET02 was unlikely to be *Sphingomonas* spp. and the isolate was tentatively classified as *Pseudomonas putida* (Hussein *et al.*, 1996). Some *Pseudomonas* spp. were reclassified as *Sphingomonas* spp. by Nohynek *et al.*,.(1995) and Haggblom *et al.*, (1995).
125 para 2	There were no phenotypic tests of ET01 undertaken. The level of 16s-rRNA sequence similarity between *Bradyrhizobium* and ET01 was "very high" (Yu, Pers. Comm., 1997).

B. ERRATA LISTING

PAGE	LINE	CURRENTLY READS	SHOULD READ
10	8	H=ggblom	Häggblom
18	13	Yu and Shepherd, 1997	Yu and Shepherd, 1997
21	26	KF1^{T}	KF1
59	18	16sRNA	16S rRNA
72	2	"incubation temperature"	"incubation temperatures"
125	4	(Yu, 1998)	(Yu, 1997)

C. BIBLIOGRAPHY

PAGE

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145 World Health Organization (WHO). 1989. Pentachlorophenol Health and Safety Guide No. 19 0259 – 7268. WHO, Geneva, Switzerland.

146 Yu, P-L and J. Shepherd. 1997. Pentachlorophenol in New Zealand: A Biological Treatment Option. Australasian Biotechnology, **7**: 340–344.

BIODEGRADATION OF PENTACHLOROPHENOL

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF TECHNOLOGY IN ENVIRONMENTAL ENGINEERING AT MASSEY UNIVERSITY, PALMERSTON NORTH, NEW ZEALAND.

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ABSTRACT

Three isolates previously isolated from pentachlorophenol (PCP) contaminated soil as a consortium were tested for their ability to remove PCP from a minimal mineral salts medium with and without vitamin supplementation. Only one of the isolates, designated *Bradyrhizobium* sp. strain ET01, could utilise PCP as a sole source of carbon and energy. The other two isolates designated *Pseudomonas putida* strain ET02 and formerly *Pseudomonas aureofaciens* strain ET03 could grow in the presence of PCP but could not utilise it as a sole source of carbon and energy. The effects of various initial PCP concentrations and vitamin supplementation on the kinetics of PCP removal and the cell numbers for ET01 and culture combinations was tested.

An increasing initial PCP concentration affected the PCP removal rate, the lag period, the cell yield, cell numbers and specific growth rate. PCP removal by ET01 ceased at a concentration of 175mg/l. The PCP removal rate increased for ET01 in pure culture through the course of the experiments. The rate of removal at 150mg/l initial PCP concentration improved from 1.48mg/l/hr to 1.85mg/l/hr. The rate of removal at 120mg/l initial PCP concentration improved from 1.38mg/l/hr to a maximum of 2.10mg/l/hr. The shortest lag period was 4 hours for ET01 in pure culture on 20mg/l initial PCP concentration. The lag period for ET01 in pure culture was 0.30 of the initial PCP concentration. The size of the inoculum of ET01 had an effect on the lag period and the rate of PCP removal. Cell yield was extremely low for ET01 and the culture combinations at all initial PCP concentrations tested. Measurable PCP removal was observed when the cell density of ET01 reached approximately $1x10^7$ cells/ml. The final number of cells for ET01 for initial PCP concentrations over the range of 20mg/l to 150mg/l was approximately $5.5x10^7$ cell per ml (0.09mg/l). The highest specific growth rate for ET01, $0.06hr^{-1}$, occurred in media containing yeast extract and at an initial PCP concentration of 40mg/l.

Continuous subculturing under the selective pressure of PCP as the sole carbon and energy source in media containing yeast extract led to an increased PCP removal rate and a decreased lag period for ET01. There was a slight increased rate effect of combining ET01 and ET02, but generally ET01 in pure culture removed PCP at a higher rate than any of the culture combinations.

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